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Mobile Networks and Applications

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Mobile Networks and Applications

The journal of special issues on mobility of systems, users, data and computing

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MONET's technical scope reflects the emerging symbiosis of portable computers and wireless networks, addressing the convergence of mobility, computing and information organization, its access and management. In approving Special Issues, the journal places an equal emphasis on the various areas of nomadic computing, data management, related software and hardware technologies, and mobile user services, alongside more "classical" topics in wireless and mobile networking. The journal documents practical and theoretical results which make a fundamental contribution, in the following, representative, areas:

- Nomadic computing, applications and services supporting the mobile user
- Design and analysis of algorithms for online and mobile environments
- Protocols to cope with mobility, limited bandwidth, intermittent connectivity
- Data management issues in mobile environments
- Mobile and wireless networks and their architectures
- Mobile node/host architectures
- Mobility management, mobile agent and proxy architectures
- Solutions for portable, mobile and roaming services
- Mobile applications, location-dependent and sensitive applications
- Systems and technologies for wireless and mobile environments, wearable computers and body area networks
- Performance characterization of mobile/wireless and nomadic systems
- Design, management and operation of emerging wireless environments
- Mobile network planning and standardization
- Integration of wireline and wireless systems
- Security, scalability and reliability in wireless communication and computations environments
- Service algorithms, emerging topics, multimedia, ATM, etc.

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A multiple access scheme for multimedia traffic in wireless ATM

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Abstract. This paper proposes a multiple access scheme for the forthcoming wireless ATM (Asynchronous Transfer Mode) system. Such ATM compatible wireless systems are motivated by the rapidly increasing demand for wireless extensions to broadband networks, which are expected to support mixed broadband services including Constant Bit Rate (CBR), Variable Bit Rate (VBR), and Available Bit Rate (ABR) traffic. Since these different traffics have very different performance requirements, the multiple access scheme design is very challenging. In this paper, we propose a multiple access scheme called Dynamic Time Division Multiple Access with Piggybacked Reservation (DTDMA/PR), attempting to achieve higher statistical multiplexing efficiency in the mixed VBR/CBR/ABR traffic scenario. The basic idea is to exploit two levels of reservation. The first level deals with the isochronous nature of CBR and VBR traffic and the bursty nature of ABR traffic by using the ALOHA reservation procedure. The second level exploits the piggybacked reservation approach to cope with the dynamic feature of VBR traffic in order to increase the multiplexing efficiency. An analytical model is also developed in this paper and verified by simulation. Numerical examples are given to gain some insight into the protocol itself.

1. Introduction

It is generally believed that the wireless system is evolving towards supporting a wide range of telecommunication services, including data, voice, video, and images. Such “multimedia capable” wireless system is motivated by the rapidly increasing demand for wireless extensions to future broadband networks. It is obvious that this extension will be very challenging because the bandwidth of the wireless system is much more limited than that of its wireline counterpart. But it is very important in the system design to provide at least qualitatively similar attributes even though quantitative equivalence is not feasible. To be compatible with the developing ATM network, the wireless ATM concept is proposed in [13]. In that paper, the possibility of supporting broadband services in the wireless environment is explored from the architecture point of view. The same issues are also discussed in [3] from the system viewpoint. Wireless ATM is a very popular topic nowadays, stimulating much research and commercial interests.

A major technical issue related to the wireless ATM system design which has a significant impact on the user performance, system capacity and complexity is the selection of the appropriate multiple access control scheme. Wireless ATM is expected to support Constant Bit Rate (CBR) traffic such as voice and CBR video, Variable Bit Rate (VBR) traffic such as teleconferencing and dial-up videophone, and Available Bit Rate (ABR) traffic such as packet data, which have very different characteristics (bit-rate range, Quality-of-Service (QoS) requirement, etc.). For example, voice telephone traffic is CBR with bit rates ranging from 2.4 Kbps to 32 Kbps, depending on the vocoder. It is either active (during voice talkspurt) or inactive (between talkspurts)

When the source is active, the CBR packet is generated periodically. It can tolerate low to medium packet loss but is not very tolerable to delay and delay jitter. On the other hand, teleconferencing is a VBR type of service with bit rates ranging from 64 Kbps to 384 Kbps. It can also tolerate packet loss but not delay and delay jitter. VBR traffic is also generated periodically but with certain dynamic characteristics. The number of packets generated in a period is a random variable instead of a fixed number as in CBR. Finally, high-speed data with bit rates from 1 Mbps to 10 Mbps requires high transfer rate and very low or no packet loss. But it can tolerate some delay and delay jitter [13]. The desired multiple access scheme must provide mechanisms to deal with each of these service types at reasonable QOS levels.

Several multiple access schemes which attempt to cope with the different features of ATM traffic can be found in the literature. Dynamic Time Division Multiple Access (DTDMA) is discussed in [13] under the integrated voice and data scenario. The frame structure is shown in Fig. 1(a). Each frame is divided into three periods, namely, the reservation subframe, the fixed allocation subframe, and the dynamic allocation subframe. In DTDMA, the voice user can make a reservation for a traffic slot in the fixed allocation subframe by using the ALOHA protocol at the beginning of each active period (or talkspurt) and can keep the slot until the end of its active period. However, the data user has to make reservations each time he has something to transmit. This protocol is designed to provide the flexibility to accommodate CBR and ABR traffic. VBR is not considered. A similar protocol called TDD ALOHA-Reservation is proposed in [15] for the integration of video (VBR) and data (ABR) in wireless LAN. Its frame structure is shown in Fig. 1(b). Each frame is divided into uplink and

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